

MEMORANDUM

TO: James Strait, FNAL
FROM: William Turner, LBNL
CC: W. Barletta, S. Chattopadhyay, J. Corlett, D. Fisher, P. Pfund, M. Furman,
E. Hoyer, K. Robinson, R. Scanlan, S. Spatafora, B. Thibadeau, J. Zbasnik
DATE: 17 Mar. 1999
SUBJECT: Feb. FY99 Progress Report for LBNL effort on the US-LHC accelerator project

Work at LBNL on the US-LHC Accelerator Project for the month of Feb. FY99 is reported below according to WBS number. Excel/Microfusion/Winsight financial reporting for LBNL was reviewed in detail during the visit of Jim Strait, Phil Pfund and Doug Fisher to LBNL 1-3 Feb. 1999. As a result of this meeting some errors were corrected and the variance analysis seems to be yielding useful and understandable results. The Field Work Proposal to be submitted to DOE for the LBNL portion of the US-LHC Accelerator Project was completed and sent to the AFRD division office on 19 Feb. 1999. Work on the IR Absorbers intensified during Feb. in preparation for the 2 Mar. 1999 CDR to be held at CERN.

1.1.1 IR quadrupoles

1.1.1.5 Cable and wedges

Inner and outer cables were manufactured at LBNL with reduced packing factors. The packing factors were reduced by removing one strand from each cable as previously agreed upon with FNAL. The cable lengths manufactured were:

IRQ Inner Cable:

LHC-3-I-00685 900m long with 37 strands. For model magnet fabrication.
LHC-3-I-00686 20m long with 37 strands. For annealing evaluation by Pierre Bauer.

IRQ Outer Cable:

LHC-4-A-00687 900m long with 45 strands. For model magnet fabrication.
LHC-4-A-00688 20m long with 45 strands. For two-pass roll forming evaluation by S. Zlobin.

Wedges 20 each at 3.5m length were ordered. Expected delivery to LBNL 26 Mar. 1999. Expected delivery to FNAL after LBNL QC inspection 9 Apr. 1999.

1.1.1.7 IR Quad EDIA

Shlomo Caspi proposed a test on the effect of axial coil pre-stress on training using model magnet HGQ001. Caspi will attend the review of the IR Quad R&D program to be held at FNAL in Mar. and discuss the merits of this proposal at that time.

1.1.3 Cryogenic lead and feed boxes

During Feb. we completed the draft of the DFBX Functional Specification and submitted it to the US-LHC Project Office for review. Further design work was done on the designs of the lambda plate, the bus bars, and the quadrupole main bus duct. In Mar. we will hold a preliminary review of the DFBX cost estimate.

1.1.4 IR absorbers

Modifications to the TAS Functional Specification modifications were completed after review by the US-LHC Project Office. The specification was formally submitted to CERN on 16 Feb.

The major effort during February was the preparation for the Absorber Conceptual Design Review taking place at CERN on 2 Mar.

Nikolai Mokhov from FNAL completed several of the action items on the list compiled during his 14-15 Jan. visit to LBNL. For the TAS and TAN radiation deposition and activation of the absorbers and the nearby magnets, shielding and tunnel have been calculated. Total integrated power deposited in the absorbers has also been calculated. The transition of the TAN vacuum chamber from two beams in a single beam tube to two beams in two tubes was changed to remove a correlation in the proposed instrumentation between the signal height and the position of the shower maximum. To do this it was necessary to reduce the thickness of the copper transition section wall to a value small compared to the nuclear interaction length (15.0 cm) and radiation length (1.4 cm). The transition previously machined from a solid block of copper was replaced with a transition fabricated from 1-1.5 mm thick copper sheet. Work on the TAN design included updating the overall layout, the absorber box layout, the vacuum chamber envelope and the tunnel cross-sections. Design notes for the TAN were written for vacuum chamber tolerances, component weights and seismic stability, in-situ bakeout and ambient cooling. The ISR jacks shipped from CERN for the TANs and DFBXs reached Los Angeles by the end of the month.

TAS layouts were developed for the ATLAS and CMS experimental caverns. Additional drawings were generated for support, bakeout and cooling of the TAS. Design notes for the TAS were completed for vacuum chamber tolerances, forced convection cooling, bakeout and support.

1.3.2 Superconducting cable support at LBNL

LHC dipole outer cable type 2. was manufactured to establish baselines of comparison between LBNL and NEEW cabling operations. The primary objective was to make cable without sharp edges. The experiments were very encouraging and will be reproduced at NEEW. As part of this cabling test S.E. Systems demonstrated the use of an eight element probe on the wide face of the cable. The results of this test are pending a report from S.E. Systems.

Spare measuring heads, seven each, have been completed and delivered to LBNL. Each head will be run through several hundred cycles on the LBNL cabling machine before shipment to CERN as part of the QC process. In addition CERN has requested coordinate measuring inspection of the heads which will be done in the LBNL machine shop before shipment.

1.4.3 LHC Accelerator physics at LBNL

1.4.3.1 Neutral absorber ionization chambers

Some work was done on a new bottoms up cost estimate of the ionization chambers as presently conceived. This has been put on temporary hold until after an instrumentation workshop at CERN 15-16 Apr. Preliminary investigations of front end pulse shaping electronics and analysis of signal to noise ratio were carried out.

1.4.3.2 Electron cloud

We did new studies of the dependence of power deposition P on the beam screen as a function of E_s , the characteristic energy of secondary electrons. Results for P versus E_s computed with the old computer "C90" and the new computers "J90" and "mcurie" agree quite well for $E_s > 1$ eV. For $E_s < 1$ eV, there are significant discrepancies, which typically show a sharp increase in P as E_s decreases. This behavior is in contrast with O. Bruning's results, which show a decreasing trend of P as E_s goes to 0. However, our calculations were initially done with a coarse space-charge grid and a large time step. When we re-did the calculation with a finer grid and smaller time step, P was observed to decrease for $E_s < 2$ eV, in qualitative agreement with Bruning. The detailed numbers, however, still disagree. For $E_s > 4$ eV, the coarse-grid calculations and the fine-grid calculations are in good agreement. The physical reason for the need for finer calculations for small E_s is that the electrons, being generated with low energy, stay near the walls of the chamber for longer times, and hence require more detailed tracking.

We also ran a very preliminary simulation with a "satellite bunch". Specifically, we assumed that there is a bunch whose charge is 1% of nominal located half-way between every pair of normal bunches. The idea (due to R. Schmidt), is that a satellite bunch would clear the slow electrons before the next normal bunch comes along, hence reducing the power deposition. The result showed that the power deposition decreased by only a few percent. This result does not rule out the idea, because there is likely to be a sensitive dependence on the position of the RF bucket carrying the satellite bunch as well as on its charge. A parametric study will be carried out in the future.

1.4.3.3 Bunch by bunch orbit correction, impedances

A report analyzing the impedance of thin metal coatings on a ceramic beam tube was completed and initial attempts at modeling the impedance of the TAN transition beam tube were carried out.